InP based generic platform: the complete and versatile solution for photonic integrated circuits

Luc AUGUSTIN[1*]
[1]SMART Photonics B.V, Horsten 1, Eindhoven, 5612AX, The Netherlands
[*]luc.augustin@smartphotonics.nl

Introduction

InP based photonic components have been around for some time and have proven to be a reliable source for communication systems. InP is the material of choice for monolithic integration of active and passive components, and with the introduction of generic integration platforms the technology has received a large boost. Researchers at TU Eindhoven have been pioneering generic photonic integration technology since the beginning of the century. In cooperation with a number of partners the generic integration technology has reached maturity [1]. The model has proven successful and InP based integration technology is currently commercially offered by two foundries [2].

Figure 1 displays a schematic representation of the technology. The integration platform makes use of butt-joint technology, this allows the integration of different material properties without compromising the performance. In this way Multi Quantum Well (MQW) gain material, optimized e.g. for high gain, can be integrated with bulk InGaAsP passive waveguides for low low losses.

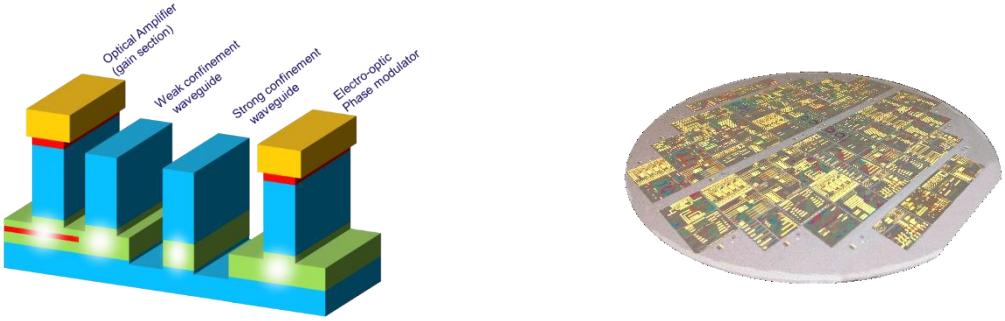

Figure 1 Schematic overview of the generic integration platform (left) and a Multi Project Wafer (right).

With this set of materials a number of Basic Building Blocks are designed and offered. These Building Blocks are offered through a Process Design Kit, implemented in software. This allows users to design on a functional level and speed up the development cycle. Most building blocks are parameterized and have their own characteristic parameters. The designer only needs to build the circuit by connecting the building blocks (with the desired parameters). This circuit can be used to run simulations to achieve the design objectives.

The standardization of the process has another big advantage. Because the process is the same for every design, for prototyping and small series, their process can be combined in a Multi Project Wafer (MPW). These MPWs offer a large cost advantage for the users, as they all share the cost of a single run.

The scale-up to larger volumes is facilitated much easier than in the case of a dedicated process. The standard process is at an industrial level already with process specifications and yield data available to allow a smooth transition from prototyping to production.

Applications

The generic model brings the technology within reach not only for large companies but also for SMEs and universities. And more importantly it opens up the technology for a number of different markets. This has been proven in the commercial MPW runs. At SMART Photonics only, approximately 200 different designs have been fabricated over the last 3 years.

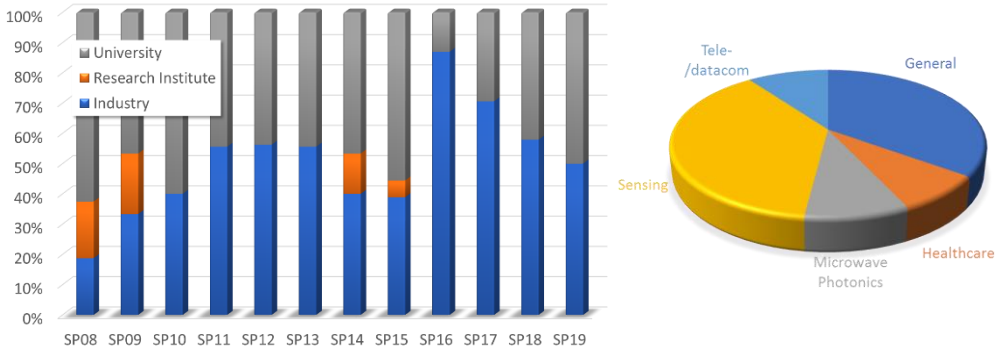

Figure 2 The percentage of users from academia and industry in the various MPW runs (left) and the application field of the designs (right)

As shown in Figure 2, the MPW were populated mainly by universities at the start, but now the share of industry is becoming larger. Overall the MPW are a good mix of product development and forward looking research with a fair share for both industry and academia. The rightmost graph shows the application fields of the users of the MPW runs for as far as this data is available. This also demonstrates the variety of markets and applications that can profit from this technology.

Conclusion

InP offers the possibility to monolithically integrate high performance active and passive components. These aspects, and the introduction of generic platforms: highly standardized industrial photonic integration processes that enable realization of a broad range of applications, will lead to a dramatic reduction of the development costs of PICs which will bring them within reach for many.

References

[1] Smit, M.K., et al. (2014). An introduction to InP-based generic integration technology. Semiconductor Science and Technology, 29(8)

[2] Joint European Platform for Photonic Integration of Components and Circuits (JePPIX) www.JePPIX.eu